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EV-Ready India: *Accelerating the Adoption of Electric Auto-rickshaws*

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Abstract

Electric auto-rickshaws (e-autos) have emerged as a promising solution, particularly for last-mile connectivity and intra-city transportation, due to their affordability, efficiency, and suitability for urban and peri-urban environments and intra-city commercial functions. However, policy discourse on e-autos often overlooks the historic and cultural dimensions of the category. Taking these factors into account can complement quantitative methods which often dominate policy discussions, acknowledging a deeper understanding of the cultural context and societal implications of adopting electric auto-rickshaws. This study, thus, aims to analyse current trends, historic and cultural significance, challenges, and opportunities in the adoption of e-autos in India, providing a holistic picture of the segment and proposing actionable policy recommendations to accelerate their uptake.

Introduction

Where do auto-rickshaws fit in the Indian transportation system?

Auto-rickshaws, or simply "autos", are a popular mode of transport in India. These three-wheeled vehicles serve as taxis, passenger carriers, and goods vehicles, offering flexible and affordable mobility solutions. These vehicles are powered by internal combustion engines with petrol, diesel, CNG (compressed natural gas), and LPG (liquefied petroleum gas) being common fuel sources, or electric motors.

The origin of the auto-rickshaw can be traced back to the creation of the automotive industry. German claims of creating a self-propelling three-wheeled vehicle have been contested; however, what can be certainly stated is that the first version of the auto-rickshaw was introduced in Japan by Mazda in 1931 (figure 1) (Mazda, n.d.). Subsequently, it was through the Japanese that the Southeast Asian markets were exposed to the vehicle that forms the backbone of their public and shared transport systems to this day.

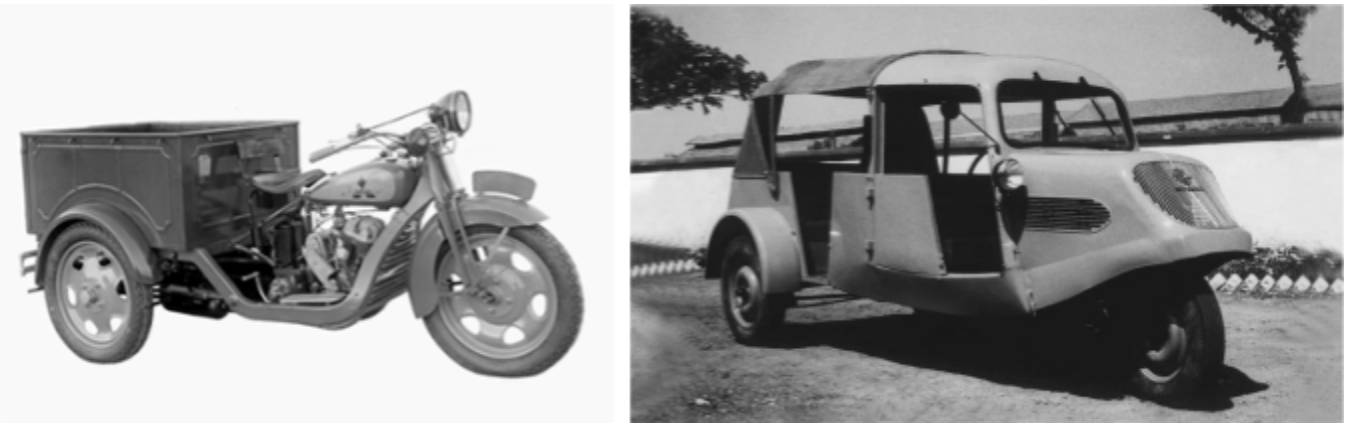

Figure 1: Left: Mazda GO, the first three-wheel truck Type-DA. Right: Minidor of Force Motors, India (Source: Team-BHP, n.d.)

The introduction of the auto-rickshaw in India, however, has followed a different trajectory. The version popular in India and now known worldwide was originally made by an Italian aircraft designer named

Corradino D'Ascanio of Piaggio by modifying the two-wheeler Vespa motorbike to transport goods cheaply during the Italian economic crises post World War II. The three-wheel version, named the Minidor, was eventually adapted by Force Motors in the 1950s. Subsequently, popularity and efficiency of the adaptation made by Bajaj became widespread (Minghong Motors, 2023). It even saw traction from government-owned public sector enterprises, with Scooter India Limited launching the Vikram auto-rickshaw, which serves many small cities and rural hinterlands of India.

Auto-rickshaws in India today are a crucial form of intermediate public transport or popular transport (Global Network for Popular Transportation, n.d.). Their importance ranks higher in areas underserved by public transport since auto-rickshaws play a key role in providing connectivity to many passengers and account for 10–20 percent of total daily trips in Indian cities (Rao, Maiti and Mulukutla, 2023). Their small size helps them navigate narrow and congested Indian roads (Rao, Maiti and Mulukutla, 2023).

Additionally, auto-rickshaws form a vital vehicle segment in the overall commercial vehicle market, especially for intra-city logistics and last-mile deliveries. Auto-rickshaws have made a significant contribution to job-creation in India, by providing livelihood opportunities to not just drivers but also those involved in repair and manufacturing. According to the Ministry of Road Transport and Highways (MORTH), there were nearly six million registered auto-rickshaws in India between 2019-20. (Ministry of Road Transport and Highway, 2023). Also categorised as cargo, autos are compact in size, affordable, easy to navigate, and have low operating costs, making them a highly suitable vehicle type to reach the consumer doorsteps- fast and efficiently. (Trucksdekho, n.d.).

Subsequently, the auto-rickshaw has become the backbone of transport across much of the global south.

Figure 2: Regions where auto-rickshaws or a variant operates (Source: author's own compilation);
Description: The image illustrates the areas with prevalence of auto-rickshaws. The areas include parts of South America and South-east Asia, Africa, and India.

Thanks to its small size, affordability and ease of manoeuvrability, the auto-rickshaw and its various avatars have become popular over the decades with the people, forming a key part of their lives in assuring an affordable means of transportation and filling the gap of conventional public transport systems (figure 2). However, it is interesting to note that over the years, the fundamental design in the vehicle has not necessarily seen any major overhaul.

Where do electric auto-rickshaws fit in the Indian market?

As per the VAHAN database, over 10 million three-wheelers, across categories, have been registered across different categories, of which the lion's share has been the 'transport' category[1]. The sector includes major Indian automakers like Bajaj Auto, Piaggio, Mahindra & Mahindra, and TVS (figure 3). These companies offer a wide range of three-wheelers catering to different needs, from passenger transport to goods delivery.

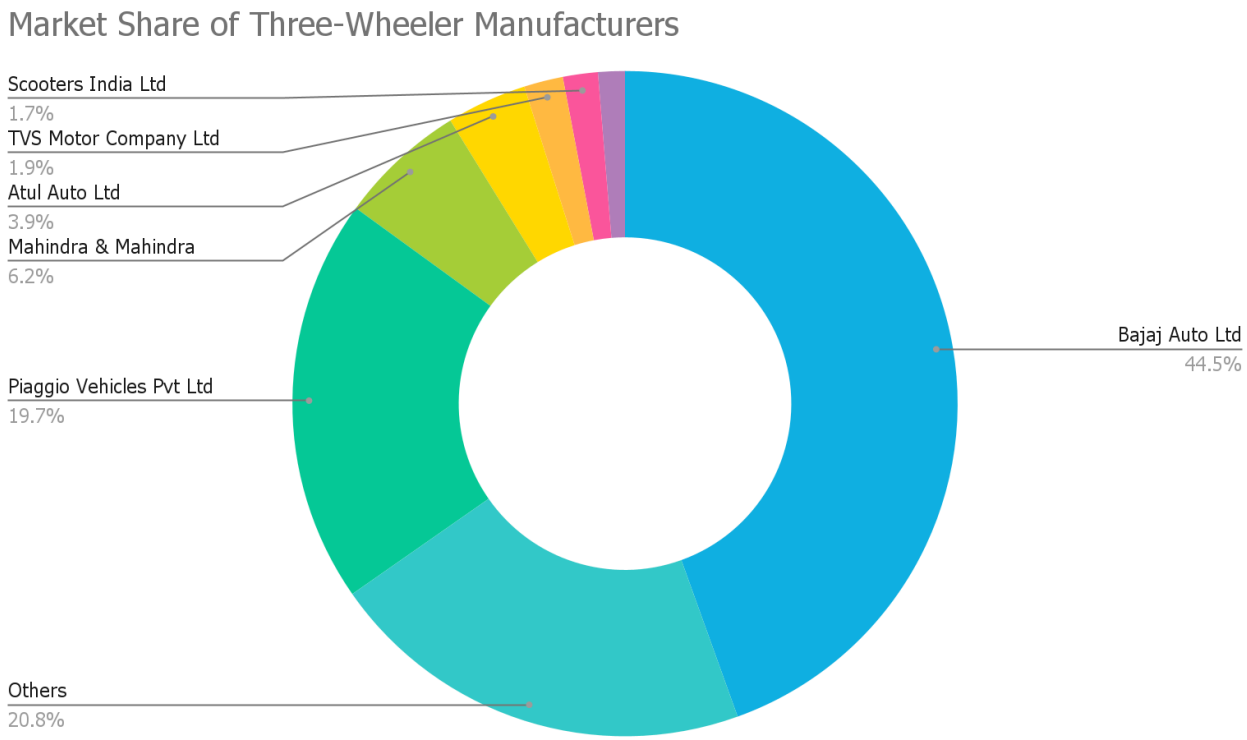

Figure 3: Major brands by market share of three-wheelers sold to date (Source: VAHAN, n.d.)

Given the huge global footprint of India in this space, it is expected that the export markets are also showing interest in the product. The manufacturers too are catching on to the interest, an example of which was seen in Piaggio Electric introducing the India-made e-autos in the Philippines market in 2023 (Economic Times, 2023). Mahindra has been exporting to the Nepal market since 2021 with its Treo model of the e-autos (Mahindra, 2021), and it has gained a fair degree of popularity. New-age Indian

[1] Transport Vehicles are used for carrying passengers or goods for hire or reward. They require specific permits and are subject to regulations like fitness tests. Some examples include three-wheelers, goods carriers, buses, and taxis.

manufacturers like Gayam have been exporting three-wheelers to Bangladesh, Sri Lanka, Philippines, Ethiopia, and Lebanon, with plans to expand to Peru and the UK markets (International Institute of Information Technology, Hyderabad, n.d.). In 2023, Race Energy, a deep-tech EV infrastructure company, announced its foray into international markets, with its pilot in Sri Lanka with Lanka e-mobility Solutions Pvt Ltd (Auto Car Pro News Desk, 2023).

However, e-auto sales are often not documented separately from e-rickshaws, despite occupying distinct market spaces. This anomaly is evident in states like Bihar, Delhi, and West Bengal, where e-rickshaw registration is mandatory and combined with e-autos for administrative convenience. This practice, in place since 2015, has led to an increase in overall three-wheeler numbers (Balachandar, 2023).

Electric Auto-rickshaws: Fuelling India's Electrification Journey

Auto-rickshaws have conventionally been powered by fossil fuels, especially diesel, in India. By 2017, over 40% of all registered transport auto-rickshaws ran on this fuel (Balachandar, 2017). The share used to be much higher till the early 2000s. However, concerned by the alarming increase of air pollution due to improper diesel combustion in the earlier two stroke auto-rickshaw engines (Whelan, 2012), the switch to compressed natural gas (CNG) took place between 2000 and 2005 in the National Capital Territory of Delhi, under judicial orders. Mumbai followed suit but, overall, the transition to gas remained limited - while CNG did come to dominate certain urban pockets, diesel and to a small extent petrol continue to be the fuel of choice (Express News Service, 2022).

However, e-autos have been steadily gaining popularity in the Indian market. Globally, China and India together account for more than 95% of all electric and 80% of conventional auto-rickshaw sales. India overtook China in 2023 to become the biggest market for e-autos, by selling over 580,000 units. India saw its sales increase by 65% with respect to 2022, thanks to financial incentives from the government, and concerted industry and policy push. While the operating costs of electric vehicles, especially commercially operated vehicles like autos, are much lower than their fossil fuel counterparts, the purchase incentives or subsidies by the government have further resulted in reducing the total cost of ownership of e-autos, thereby boosting their sales across the country (IEA, 2024; OMI Foundation, n.d.).

The adoption trends in India speak for themselves. As the EV-Ready India dashboard highlights, the past few months have witnessed consistent adoption of e-autos in both the goods and passenger vehicle segments. The month of April 2024 saw 52.38% of all new registered passenger autos as EVs, while in the case of three-wheeler goods carriers, 53.19% of all new registered vehicles were electric (EV-Ready India Dashboard, 2024). The adoption rates are even higher in many states, as the dashboard highlights the following state-level trends for April 2024[2].

1. Three-wheeler goods: 99.1% of all goods three wheelers registered in Meghalaya in April 2024 were electric, followed by Delhi (93%) and Chandigarh (84%).
2. Three-wheeler passenger: All new auto-rickshaws registered in the month of April 2024 in Chandigarh were electric. This was followed by Delhi (98.5%) and Jammu Kashmir (95.9%).

[2] Three-wheeler goods and three-wheeler passenger both refer to auto-rickshaws. These may not be confused with or expanded to cover other three-wheeler variants like rickshaws.

Further, with the current sales trends,the EV-Ready India dashboard estimates that e-auto sales will reach 1,80,000 vehicles per month by December 2030. However, this number is conservative due to the highly regulated passenger three-wheeler market. Some state governments have issued permits, limiting the overall number of vehicles. In Delhi, the Supreme Court has capped the number of auto-rickshaws at 1,00,000 since 2011 (Economic Times, 2021).

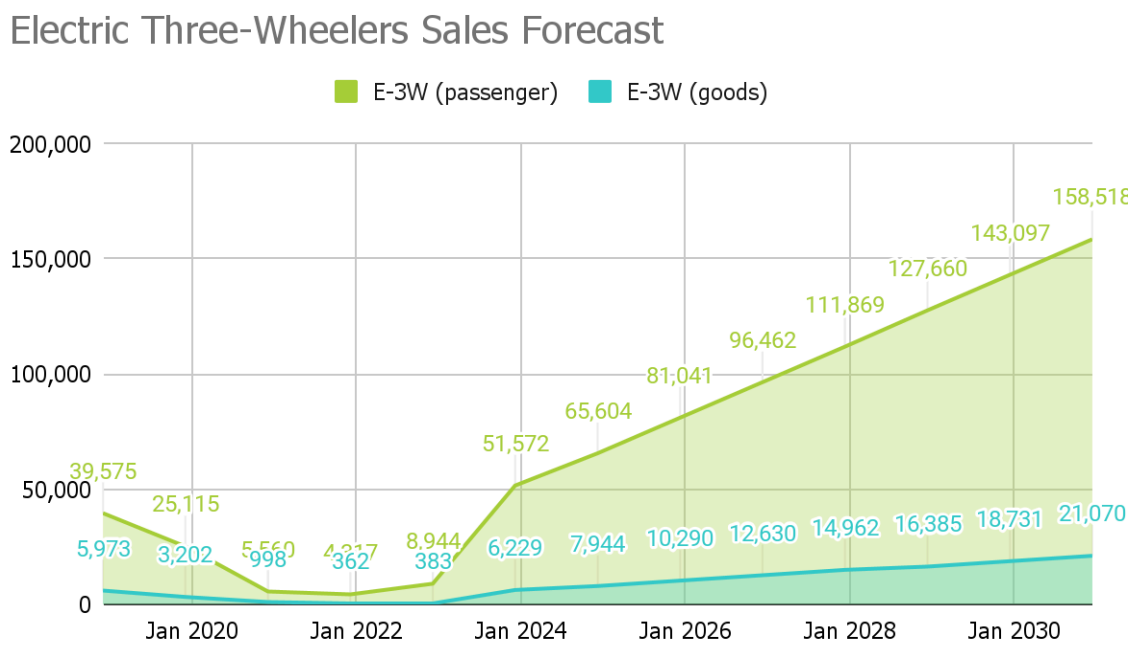

Figure 4: Forecast on EV Sales by December 2030 (Source: EV-Ready India Dashboard)

Factors Affecting Electric Auto-rickshaws Adoption in India

1. Policy Factors

Unlike the global north, India's electric mobility journey is spearheaded by small form factors like two- and three-wheelers, as evidenced and enabled by favourable policies and market forces. There are national initiatives, like the National Electric Mobility Mission Plan (NEMMP) 2020, target infrastructure development, regulatory frameworks on technical and performance standards, skill training, and battery manufacturing, all of which indirectly support the growth of e-autos. In terms of direct policies, the primary ones are:

1. **FAME Scheme:** The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme provided financial incentives for EV manufacturing and adoption. Significant funds were earmarked for electric three-wheelers, offering subsidies to manufacturers and end-users, with the end goal of making EVs more affordable and accessible. To date, 1,69,784 electric three-wheelers[3] have been supported under this scheme (DHI, 2024).

[3] The source doesn't make a distinction between e-autos and e-rickshaws. Therefore, electric three-wheelers could include both.

2. **Electric Mobility Promotion Scheme (EMPS):** With the culmination of the FAME Scheme, the Government of India released the EMPS Scheme in March 2024. This is a limited fund scheme with a total outlay of INR 500 crore for the period of 4 months - April to July 2024 for faster adoption of electric two-wheeler and three-wheeler (Press Information Bureau, 2024). The scheme intends to support 38,828 electric three-wheelers (e3w) (including 13,590 rickshaws & e-carts, and 25,238 e-3W in L5 category, i.e. e-autos) fitted with advanced batteries.

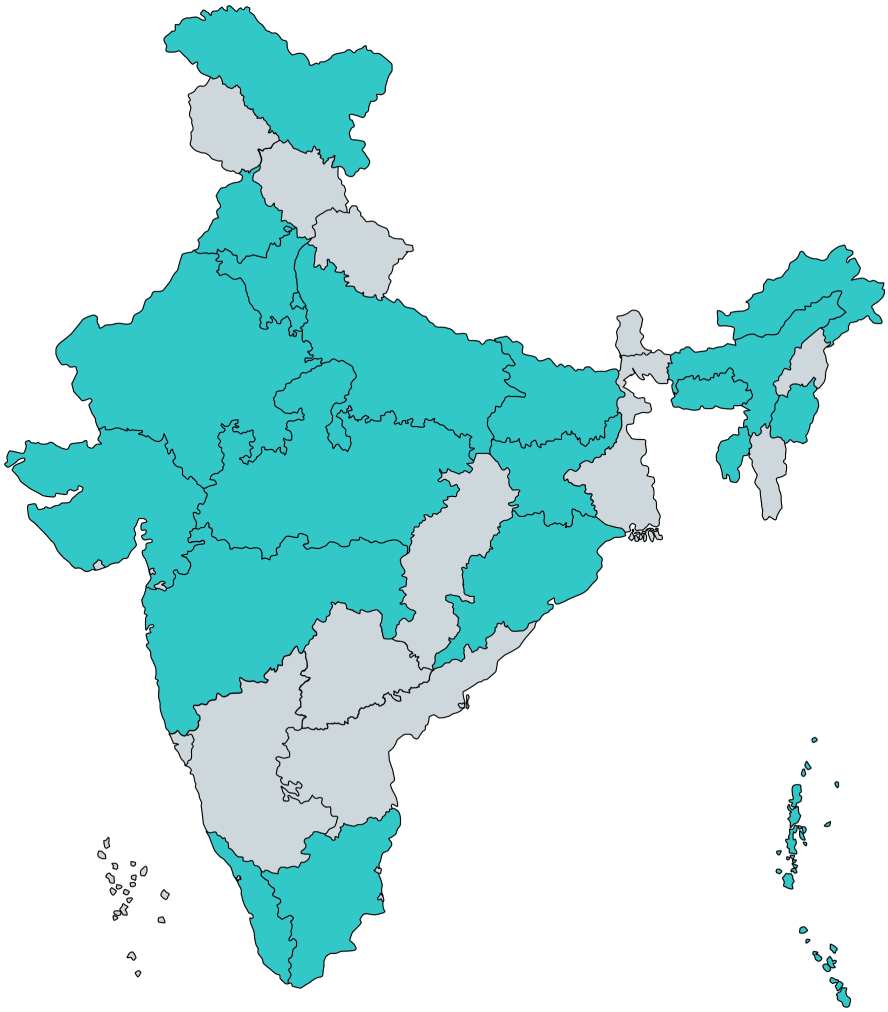

Figure 5: States offering purchase incentives for electric three-wheelers (including e-rickshaws and e-autos) in India (Source: EV-Ready India dashboard)

3. **State-Level Policies and Incentives:** Several Indian states have implemented specific EV policies tailored to their unique requirements. These policies often include
    a. Incentives for electric three-wheelers, such as tax reductions, registration fee waivers, and direct subsidies. As per the EV-Ready India Dashboard, states like Delhi, Karnataka, Tamil Nadu, and Maharashtra offer purchase incentives and scrapping bonuses for old vehicles to encourage a shift to electric three-wheelers (figure 5).
    b. EV-specific roadmaps and policies at the state level often include targets for electric three-wheeler adoption, promoting electric vehicle infrastructure, and creating green

corridors or dedicated lanes for electric vehicles.

2. Cost Differentials are in Favour of Electric Auto-Rickshaws

Despite the upfront price being 55% higher than for its petrol equivalent, the average electric 3W model (auto-rickshaw) is more than 50% cheaper to own after 8 years of service, and even without subsidies is over 40% cheaper (IEA, 2024). Even when considering the most cost-effective ICE auto running on natural gas, the electric model achieves TCO parity as soon as two years after purchase, and works out about 40% cheaper over an 8-year lifetime. However, subsidies still play an important role, as without them, the TCO breakeven point is only reached after 4 years (IEA, 2024). Further, the transition to electric auto-rickshaws can result in higher incomes and savings for drivers, especially after subsidies.

Another pan-India study too, like many others, draws a similar conclusion. As can be seen in Figure 6, over a 10-year operating period and accounting for two battery replacements too, electric auto-rickshaws are cheaper than their fossil fuel counterparts (Kanuri et al, 2023).

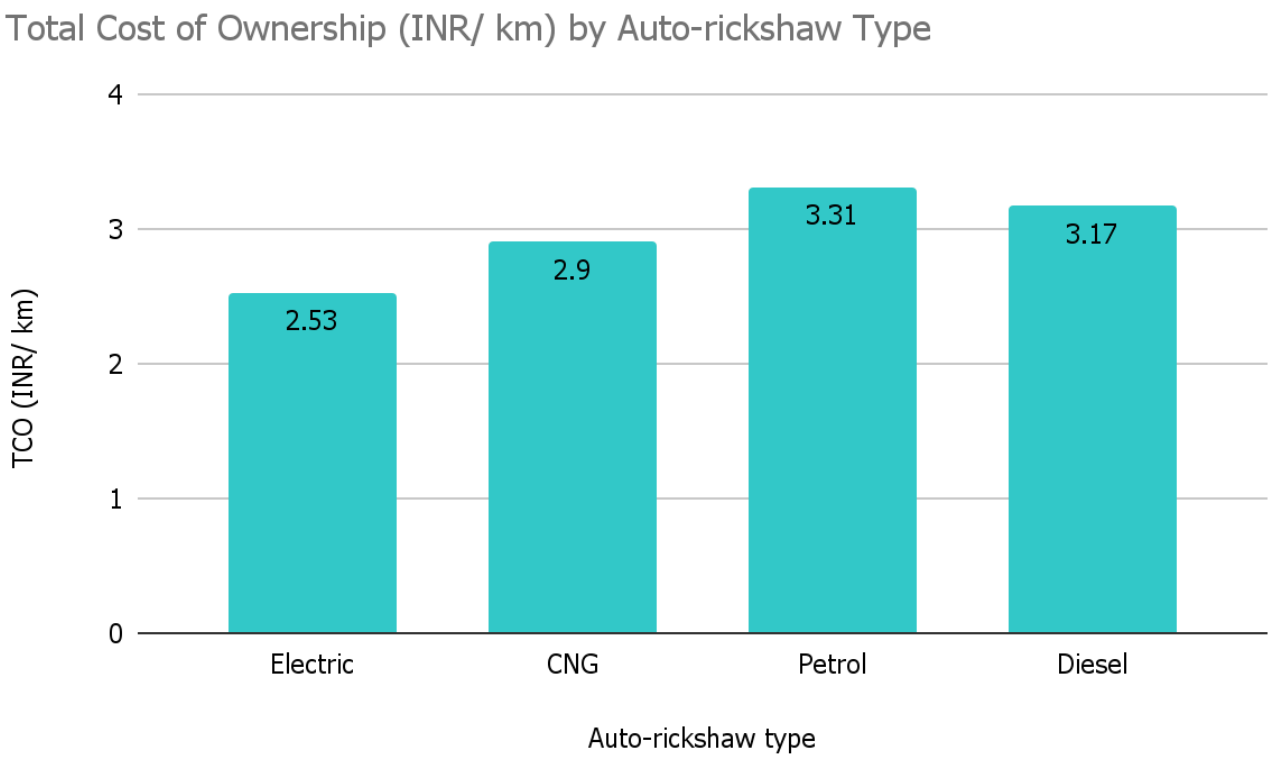

Figure 6: TCO for Different Types of Autos Over a 10-year Period (Source: Kanuri et al, 2023).

An important contributor to the lower TCO, which also addresses the question of range anxiety, is the average trip length. As we have seen in the Ease of Moving Index 2022, an average trip length does not exceed 10 km in the top 40 most populated cities of India (see Annexure 1) (OMI Foundation, 2023). What is interesting to note is that the auto-rickshaws constitute as much as a fifth of the mode share of an average passenger's trip in these cities (OMI Foundation, 2023).

3. Environmental Factors

Environmental factors, particularly concerns on air pollution and resultant health of drivers of autos and other road users, have led to greater thrust on e-autos operations in major cities. Delhi has replaced its CNG fleet with e-autos, a decision upheld by the Supreme Court (Hindustan Times, 2021). Bulk electric auto permits have boosted last-mile connectivity (The Print, 2023). The Commission for Air Quality Management has recommended registering only electric or CNG autos and phasing out diesel autos in the National Capital Region (CAQM, 2022). The phase out guidance is important, as it had a direct bearing on the states of Uttar Pradesh, Rajasthan, Haryana and Punjab.

Many fossil fuel or internal combustion engine (ICE) auto-rickshaws in India continue to operate on two-stroke engines, which are a major source of particulate matter emissions. This is particularly evident in cities like Bengaluru, where these engines contribute approximately 114.6 tonnes of PM10 emissions annually (Kanuri et al, 2023). High emissions are caused due to the incomplete combustion of fuel, leading to environmental pollution and impacting the power and torque output of these vehicles. In contrast, the e-autos - with its zero tailpipe emissions, and decarbonising effect on the rest of the mobility value chain[4] - stands as an attractive alternative.

Electric autos offer significant climate benefits. Lifecycle emissions for diesel and CNG auto-rickshaws stand at 177 grams of carbon dioxide equivalent (gCO2e) per vehicle km, equivalent to nearly 13 balloons filled with CO_2[5] or a typical 100 watt light bulb running for 3.8 hours and 122 gCO2e of GHG emissions, equivalent to nearly 9 balloons or a typical 100 watt light bulb running for 2.6 hours, per vehicle km respectively. Since auto-rickshaws have a higher daily usage (vehicle kilometres travelled per day) as compared to other personal transport modes, a transition to e-autos can substantially reduce emissions of CO_2 and other pollutants, and produce health benefits for urban inhabitants (Kanuri et al, 2023).

4. Cultural Underpinning of Electric Auto-rickshaws

Electric auto-rickshaws can be seen as an example of the Indian concept of "jugaad" - a frugal, flexible, and inventive approach to problem-solving and innovation. It showcases how individuals and communities leverage their creativity and resourcefulness to overcome constraints and challenges (Prabhu & Jain, 2015). Jugaad also has significant implications for social empowerment. It democratises innovation by enabling the 'common man' to participate in creating solutions that address everyday problems (Kaur, 2016). Economically, jugaad encourages a form of grassroots economic development. By creating low-cost solutions, it allows for the generation of value and productivity in environments that may lack significant investment or infrastructure (Bansal, 2011). Culturally, jugaad challenges and influences formal educational and professional frameworks by integrating informal, non-linear thinking into traditional curricula and business practices (Verma, 2019). However, there is a tension between jugaad as a quick-fix solution and the need for sustainable, systematic innovation. While jugaad provides

[4] Notably, several policy and industry-led initiatives are underway to integrate renewable energy with electric vehicle charging solutions. Additionally, it is noteworthy that India has exceeded its renewable energy generation targets, and stands 4th globally in Renewable Energy Installed Capacity, and Wind Power Capacity. (source: Press Information Bureau)

[5] 1 litre of CO_2 weighs approximately 1.98 g. A balloon with 9" can hold up to 13.86 g of CO_2. It would take 12.77 9" diameter balloons to fill 177 grams of CO_2; similarly, it would take 8.8 9" balloons to fill 122 g CO_2.

immediate, cost-effective solutions, it may lack the scalability and sustainability that come from more formal innovation processes (Ananthram & Chan, 2019).

Some Hurdles Still Need to be Overcome

In a market with such a huge number of three-wheelers, including autos and rickshaws, in operation, achieving an electrification rate of 30% to 50% in a short span of time is a remarkable accomplishment. However, to further accelerate this progress and reach the ambitious target of 100% electrification in the near future, certain challenges have to be overcome. These challenges can currently be bucketed under four broad categories (Harikumar et al, 2022):

1. Infrastructure Limitations: India's charging infrastructure is inadequate for the growing number of electric vehicles, and this holds true just as much for the e-autos as well. The distribution of charging stations is uneven in two ways - the urban-rural divide and the uneven distribution among districts when compared to actual vehicle distribution. This disparity creates "range anxiety," where drivers fear running out of charge without a nearby station. This infrastructural inadequacy can especially impact operations of commercial vehicles, leading to reduced productivity. It is also to be noted that many of the drivers do not have the parking space for auto-rickshaws at home, thus making public charging infrastructure's availability critical (Harikumar et al, 2022). Additionally, the reliability of electricity supply can be an issue in some regions, impacting the usability of electric vehicles.

2. Battery Technology Concerns: The performance of electric three-wheelers, including e-autos and e-rickshaws, is heavily dependent on battery quality. A key manufacturing challenge faced by OEMs is the scarcity and high cost of raw materials such as lithium-ion cells for batteries which increases the dependency on imports. This acts as a major roadblock towards investments in the sector (TOI 2022), which can be reduced by localisation of the value chain, which is still an ongoing process (Kanuri et al, 2023).

3. Barriers faced by Financial Institutions: Financiers face higher risks when financing three-wheelers due to five key factors: counterparty, product, operations, repossession, and residual risks. Many customers are new-to-credit and exhibit payment delays. The presence of multiple startups in the space, including vehicle manufacturing and fleet operations, adds to the perceived business risk, as financiers fear these startups may default as market players consolidate (NITI Aayog, SIDBI and RMI, 2024).

4. Regulatory Framework: The regulatory environment for electric three-wheelers remains an evolving space. While there are initiatives to promote electrification, inconsistent policies and enforcement can create uncertainty. Policymakers need to boost ground-level initiatives, such as lowering upfront costs, improving access to finance, and scrapping old autos (Thakur and Pal, 2019). Goods carriage permits are issued to three-wheelers used for transporting a certain maximum load within a specified area, generally within a state.

Contract carriage permits are issued for vehicles engaged under a contract for passenger carriage on a time basis or from one point to another (Rao, Maiti and Mulukutla, 2023). In most metropolitan cities, a closed permit is issued for auto-rickshaws to avoid road congestion, while smaller cities with limited

public transport practice an open permit system (Thakur and Pal, 2019). Efforts by governments to favour electric three-wheeler adoption have faced judicial challenges or social problems, slowing their adoption (John, 2020).

Policy Recommendations to Further the Adoption of E-Autos

The widespread adoption of electric vehicles (EVs) globally is heavily influenced by the availability of charging infrastructure. Cities and countries that have invested in developing a robust network of charging stations have seen significant growth in EV adoption, while those with limited charging infrastructure have faced challenges in scaling up EV usage (UCLA & Ola Mobility Institute, 2020). Based on the four limitations specified in the previous section, this paper proposes key recommendations for various stakeholders of the electric mobility ecosystem. .

1. Strategic Expansion of Public Charging Infrastructure

Alternatives like battery swapping could mitigate range anxiety and reduce vehicle downtime, but they have yet to scale up in India. Nevertheless, a robust network of public charging stations is needed, which could be driven by public-private partnerships, particularly in urban areas.

EV owners prefer charging locations based on accessibility, speed, and cost. Workforce population, mobility, road characteristics, and parking spaces influence optimal charging station locations (Charly et al, 2023). This leads to three types of charging stations, with factors causing variance in siting strategy (table 1). Given the lack of home charging for three-wheelers, emphasis should be on en-route or destination charging. The strategy for charging infrastructure development should address questions like siting charging stations appropriately (Kalakanti and Rao, 2022).

1. Given a city and layout with several charging stations, what is the standard recommendation of State of Charge for EV users to go for charging with a high success rate in finding a station nearby?
2. Given the EV penetration of an area and the quality of service, i.e., state of charge, what is the charging station requirement?
3. How does the charging station need planning change when the penetration changes in a planning area?

Charging Requirement Type	Essential Focus	Siting Criteria
Shared-residential charging/ night-time home charging	• Charging infrastructure is expected to cater to residences without off-street parking • Mainly intended for overnight slow charging near houses and apartments.	Appropriate criteria for selecting these shared-residential charging stations could be population density since it is directly linked with the number of trips generated in the area ensuring adequate utilisation of the chargers, availability of overnight parking spaces, and desirable walking distances for the auto drivers. Some companies are also trying to identify clusters where auto drivers reside to set-up chargers which may also be explored further.
En-route charging	• Typically caters to long-distance EV travellers, can be located along major roads near service stations, and would require fast charging, complemented by battery swapping.	Proximity to motorways and service stations, location safety, and parking potential is relevant for locating ideal en-route charging stations
Destination charging/ daytime charging	• This aims to provide top-up charging, especially near facilities like supermarkets, shopping centres, and public transit stops. These stations can have slow to rapid charging options.	Proximity to social areas and activity centres, availability of parking lots, accessibility, and time spent charging or parking are factors considered for locating ideal destination charging stations

Table 1: Type of Charging Requirements and Siting Criteria (Source: Charly et al, 2023; EV Story, 2023)

2. Encouraging Battery Technology Research and Development

The cost, weight, and durability of batteries are critical to the success of electric vehicles including autos. The evolution in battery technology in the last few years has played an important role in affecting consumer sentiment positively, resulting in a rise in demand for e-autos for goods and passenger services (Kochar, 2022). Continued investment in research and development, particularly battery innovation focusing on strong industry-academia-government partnerships, is needed to produce affordable and lightweight batteries with extended lifespans. (Karuturi, 2022) This in turn can help improve the battery performance significantly and reduce costs (Kochar, 2022). Advancements in

solid-state batteries and improved energy density can help e-autos achieve longer ranges, enhancing their appeal to operators.

3. Overcoming Financial Barriers Through Innovation

While subsidies/ demand incentives and leasing options can lower the initial cost barrier thereby making electric vehicles more accessible, there is a greater need to ensure lower cost of borrowing to purchase electric autos. In this regard, De-Risking Measures (DRMs) are crucial, and need to be activated at the earliest. DRMs can reduce risk premiums, making lending terms more favourable by a variety of outcomes, including (NITI Aayog, SIDBI and RMI, 2024):

- Potential interest rate and fee reductions
- Extended loan tenures
- Higher LTV ratios, and
- Increased participation and risk underwriting by financiers.

Technology-enabled entities can work with financiers to offer DRMs as services to them, as well as to other participants in the EV ecosystem, including OEMs, fleet operators, and insurance companies. These services can address common challenges faced in the EV ecosystem, such as digitising payment mechanisms, strengthening repossession systems, extracting insights from telematics data to predict battery life, and optimising the financial value of repossessed assets (NITI Aayog, SIDBI and RMI, 2024).

4. Promoting Regulatory Framework Unlocks

A supportive regulatory environment is vital for accelerating EV adoption, including e-autos. Governments should focus on options to favour e-autos, such as streamlining the permit system and increasing the number of permits. Stringent emission standards for petrol and diesel autos can be implemented at the state level, starting with non-attainment cities. OEMs, aggregators, and fleet operators can participate in a domestic carbon market, ensuring benefits from fleet-level decarbonisation and lower electric three-wheeler prices.

Indian Electric Auto - Global South's Vehicle of Choice

The global influence of the Indian three-wheeler industry has been a story of the global south's quest for affordable mobility. Indian manufacturers have become major exporters of three-wheelers to countries in Africa, Asia, and Latin America. Even though India's exports have slumped in recent times (figure 7) (Patel, 2024) (SIAM, 2023), India remains the largest three-wheeler exporter of the world. The slump has much to do with conflicts in countries of the global south that were major export destinations (Patel, 2024). However, Indian auto-rickshaws retain popularity in the global south - these regions share similar urban challenges, including high population density and limited infrastructure. As a result, the export of Indian-made three-wheelers has grown substantially, contributing to economic growth and employment in India, even creating a whole economy around the product in the country of export (see case study).

Case Study: The Indian Auto-rickshaw in Small Town Egypt

Simbalawayn is a town of 100,000 inhabitants in Egypt. Like other small regional urban centres of the global south, it was bereft of public services, especially public transport. The auto-rickshaw first appeared in the town in the year 2000, when a small-scale merchant named Ghazi, a textile trader, decided to gamble on the auto rickshaw. He persuaded his local partners in Port Said to advance funds and mobilise a Mumbai supplier to send auto rickshaws. Following months of pressure on the Indian counterpart Nayan, a sceptical Nayan yielded to the pressure and contacted an acquaintance who resold rickshaws on the Indian market. His first delivery to Egypt – eight motorised vehicles – ended up planting the seeds of a hugely successful business venture. When the first auto rickshaws hit the streets of Simbalawayn (where it all began), they caused a stir. Rumours started to spread, and soon other merchants wanted in on the action.

Motorised rickshaws clicked as they filled a tacit mobility need, providing an innovative mode of transport in the most lucrative market segment. The vehicles provided a new service to marginalised city dwellers and dignity of work to those who operated them. The big impact was on the lives of most residents of small cities and peripheral suburbs, affording them unprecedented mobility, making it very popular with the locals.

Source: Tastevin, 2015

India's auto-rickshaws have gained significant popularity globally, particularly in South East Asia and other developing regions. They are exported to over 20 countries, including those in Southeast Asia, Africa, and Latin America, and are well received in countries like Indonesia, Malaysia, the Philippines, Nigeria, Ghana, Kenya, Brazil, Mexico, and Argentina. The success of the Indian auto-rickshaws can be attributed to their affordability, durability, and low maintenance cost. Therefore, it's not surprising that the Indian three-wheeler industry has inspired other countries to develop similar modes of transport, often adopting or adapting Indian designs to meet local needs. This has led to a proliferation of autos worldwide, with some regions even developing electric variants to address environmental concerns. A particular threat today comes from China; however, India remains at the top with the leading transition of this segment of transport towards electric forms (IEA, 2024).

India's significant global presence in the auto-rickshaw industry is a testament to its influence in the space. Indian manufacturers expanding their global footprint is a reflection of the industry's focus on technological innovation and sustainability, driven by growing environmental awareness. This shift towards low-emission solutions is supporting global sustainability goals, positioning India as a leader in low-emission mobility. The demand for Indian-made sustainable auto-rickshaws is fueled by consumers and governments seeking cleaner transportation options, further solidifying India's position as a pioneer in sustainable mobility. India has the opportunity of offering the global south a solution to solve the service gap arising from the shortage of adequate public transport while adhering to many sustainable development goals (SDGs) including dignified livelihood opportunities and clean mobility, particularly at scale. That should be the ambition of the e-auto industry, much like the automotive industry of India, which has helped the world address its mobility challenges in an efficient and cost-effective manner.

Annexure 1: Average Trip length in Indian Cities

The following table contains the components of first and last-mile connectivity in 40 Indian cities based on the *Ease of Moving Index - India Report 2022* (OMI Foundation, 2023). These parameters indicate that in most cities, the average trip length does not exceed 10 km, and the average trip time does not exceed 10 minutes. While the causation needs to be established, this table indicates a travel pattern that fits the offerings of e-autos.

City	Average trip length	Average time to reach transit hub	Average wait time at the stop	Public transport mode-share	Three-wheeler mode share
Agartala	5.06 Km	8 min 4 sec	9 min 20 sec	66.23%	7.96%
Aizawl	8.3 km	8 min 44 sec	10 min 40 sec	44.38%	15.95%
Bhubaneshwar	9.79 km	7 min 1 sec	7 min 45 sec	89.61%	17.42%
Dehradun	8.37 km	7 min 55 sec	8 min 28 sec	70.97%	10.8%
Jammu	7.07 km	9 min 31 sec	10 min 22 sec	47.04%	18.4%
Kochi	7.84 km	8 min 22 sec	8 min 51 sec	96.69%	12.71%
Kohima	6.66 km	8 min 21 sec	9 min 50 sec	54.81%	10.39%
Panaji	8.2 km	8 min 58 sec	10 min 15 sec	55.01%	17.02%
Shimla	5.41 km	7 min 47 sec	9 min 3 sec	36.12%	9.11%
Thiruvananthapuram	6.89 km	10 min	12 min 45 sec	58.86%	9.65%
Udaipur	5.43 km	7 min 51 sec	9 min 1 sec	35.90%	11.9%
Chandigarh	8.08 km	8 min 48 sec	10 min 11 sec	55.28%	16.5%
Coimbatore	9.67 km	6 min 56 sec	8 min	86.56%	16.92%
Gurugram	7.19 km	8 min 38 sec	9 min 27 sec	83.07%	4.49%
Guwahati	9.81 km	7 min 1 sec	7 min 45 sec	90.26%	17.14%
Jabalpur	8.29 km	8 min 57 sec	10 min 41 sec	43.39%	6.48%
Ludhiana	5.49 km	7 min 43 sec	9 min 7 sec	37.85%	7.89%
Mysuru	7.34 km	9 min 35 sec	11 min 38 sec	51.9%	14.08%
Nashik	8.25 km	9 min 3 sec	11 min 8 sec	41.65%	15.61%

Raipur- Nava Raipur	7.88 km	8 min 8 sec	8 min 42 sec	100%	13.97%
Ranchi	8.14 km	9 min 17 sec	11 min 7 sec	42.63%	16.39%
Varanasi	5.39 km	8 min 8 sec	9 min 8 sec	70.49%	8.81%
Vijayawada	9.75 km	7 min 47 sec	7 min 30 sec	26.65%	18.77%
Bhopal	8.28 km	8 min 35 sec	9 min 52 sec	47.93%	6.79%
Indore	6.1 km	8 min 21 sec	9 min 15 sec	73.93%	7.82%
Jaipur	4.99 km	7 min 49 sec	8 min 38 sec	75.45%	6.96%
Kanpur	5.54 km	7 min 53 sec	9 min 2 sec	68.3%	7.66%
Lucknow	5.41 km	8 min 4 sec	9 min 10 sec	69.11%	8.80%
Nagpur	4.68 km	7 min 43 sec	8 min 27 sec	78.73%	2.01%
Patna	5.52 km	8 min 4 sec	9 min 7 sec	69.94%	7.81%
Visakhapatnam	8.01 km	9 min 4 sec	11 min 1 sec	41.83%	14.98%
Ahmedabad	8.08 km	8 min 22 sec	9 min 35 sec	61.48%	14.78%
Bengaluru	6.95 km	8 min 11 sec	9 min 18 sec	66.49%	10.24%
Chennai	8.8 km	8 min 9 sec	9 min 2 sec	95.82%	9.89%
New Delhi	6.97 km	8 min 17 sec	9 min 20 sec	83.98%	10.41%
Hyderabad	5.48 km	8 min 12 sec	9 min 16 sec	83.63%	0.20%
Kolkata	8.87 km	8 min 19 sec	9 min 24 sec	82.95%	9.99%
Mumbai	4.97 km	8 min 8 sec	8 min 60 sec	98.93%	0.88%

References

Ananthram, S., & Chan, C. (2019). Institutions and frugal innovation: The case of Jugaad. Asia Pacific Journal of Management, 38, 1031-1060. https://doi.org/10.1007/s10490-019-09700-1.

Anna Charly, Nikita Jayan Thomas, Aoife Foley, Brian Caulfield (2023). Identifying optimal locations for community electric vehicle charging. Sustainable Cities and Society, Volume 94, 2023, 104573, ISSN 2210-6707, https://doi.org/10.1016/j.scs.2023.104573.

Auto Car Pro News Desk. (2023, Dec). RACE Energy enters Sri Lanka in partnership with Lanka E-Mobility Solutions. Auto Car Pro. Retrieved June 4, 2024, from https://www.autocarpro.in/news/race-energy-enters-sri-lanka-in-partnership-with-lanka-e-mobility-solutions-118265

Balachandar, G. (2023, March 27). E-rickshaws drive EV penetration in three-wheelers to over 50% in FY23. The Hindu businessline. Retrieved from https://www.thehindubusinessline.com/economy/e-rickshaws-drive-ev-penetration-in-three-wheelers-to-over-50-in-fy23/article66664740.ece.

Bansal, P. (2011). From Jugaad to Systematic Innovation: The Challenge for India. The Indian Journal of Industrial Relations, 46, 536.

Bhattacharya, A. (2024, April 9). India's electric rickshaws are leaving EVs in the dust. Rest of the World. https://restofworld.org/2024/e-rickshaw-yc-electric-india/.

Commission for Air Quality Management in the National Capital Region and Adjacent Areas (2022, November 30). Direction No 70. Abating air pollution from public transport sector - Regulations on Diesel operated Autorickshaws. https://caqm.nic.in/WriteReadData/LINKS/Direction%20No-7028ef4ee0-1fd1-4e9b-91d7-fedbd4d22508.pdf.

Economic Times (2021, September 28). Delhi govt to move SC for removal of one-lakh cap on auto-rickshaws in favour of electric ones. Retrieved from https://auto.economictimes.indiatimes.com/news/commercial-vehicle/lcv/delhi-govt-to-move-sc-for-removal-of-one-lakh-cap-on-auto-rickshaws-in-favour-of-electric-ones/86587659.

Economic Times (2023, February 14). Piaggio Vehicles announces entry of Ape Electrik 3-wheeler in Philippines. The Economic Times. https://economictimes.indiatimes.com/industry/renewables/piaggio-vehicles-announces-entry-of-ape-electrik-3-wheeler-in-philippines/articleshow/97911545.cms?from=mdr.

EV Story. (2023, February). Mahindra Last Mile Mobility Sets Up 3-Wheeler EV Charging Stations. evstory.in. Retrieved June 3, 2024, from https://evstory.in/mahindra-last-mile-mobility-sets-up-3-wheeler-ev-charging-stations/

Express News Service. (2022, December). Diesel autorickshaws to be phased out in NCR by 2026-end. Indian Express. Retrieved June 3, 2024, from https://indianexpress.com/article/cities/delhi/delhi-ncr-diesel-autorickshaws-to-be-phased-out-2026-end-8301810/

Global Network for Popular Transportation. (n.d.). About words — The Global Network for Popular Transportation. The Global Network for Popular Transportation. Retrieved June 3, 2024, from https://www.populartransport.net/about-words

Harikumar, Aravind, Anand RM, Himani Jain, and Sowmia Philip. 2022. India's EV Transition: Catalysing Kochi's Electric 3-Wheeler Market Through Local Policy. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/ceew-research-on-electrification-of-3-wheeler-auto-rickshaw-market-through-local-policy-in-kochi.pdf.

Hindustan Times (2021, December 16). SC stands by Delhi government's call to register only electric autos. https://www.hindustantimes.com/cities/delhi-news/scstands-by-delhi-government-s-call-to-register-only-electric-autos-101639593938036.html.

IEA (2024), Global EV Outlook 2024, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2024, Licence: CC BY 4.0.

International Institute of Information Technology, Hyderabad. (n.d.). Gayam Motor Works shows how to conductor business -. IIIT Blog. Retrieved June 4, 2024, from https://blogs.iiit.ac.in/monthly_news/gayam-motor-works-shows-how-to-conductor-business/

Jackson, E. (2023, May). Government Implements Measures to Combat Black Marketing of Fertilizers. Chemanalyst.news. Retrieved May 8, 2024, from https://www.chemanalyst.com/NewsAndDeals/NewsDetails/government-implements-measures-to-combat-black-marketing-of-fertilizers-17256.

John, H. (2020, February 12). Kerala e-auto owners allege harassment by other auto drivers over loss of jobs. The News Minute. https://www.thenewsminute.com/kerala/kerala-e-auto-owners-allege-harassment-other-auto-drivers-over-loss-jobs-118042.

Kalakanti, Arun Kumar, and Shrisha Rao. 2022. "Charging Station Planning for Electric Vehicles" Systems 10, no. 1: 6. https://doi.org/10.3390/systems10010006.

Kanuri, C., Gounder, K., Sandhu, B. J. K., and Laroiya, A. (2023, October). ENABLING THE SHIFT TO ELECTRIC AUTO-RICKSHAWS: A Guidebook for Electrification of Auto-rickshaw Fleets in Indian Cities. https://citiis.niua.in/web/sites/default/files/2023-11/E-Auto%20Guidebook.pdf.

Karuturi, P. (2022, November). India to become a battery manufacturing powerhouse needs joint coordinated efforts from the government and the industry. https://emobilityplus.com/2022/12/28/emobility-india-oct-nov-2022-issue/

Kaur, R. (2016). The innovative Indian: Common man and the politics of jugaad culture. Contemporary South Asia, 24, 313 - 327. https://doi.org/10.1080/09584935.2016.1214108.

Kochar, S. (2022 September 01). Electric three-wheeler battery technology. https://www.linkedin.com/pulse/electric-three-wheeler-battery-technology-samrath-kochar.

Kumar, A., & Roy, U. K. (2019, August 28). E-Rickshaws as Sustainable Last Mile Connectivity in an Urban Dilemma: Case of Delhi. ASCE Library. Retrieved May 8, 2024, from https://ascelibrary.org/doi/10.1061/9780784482582.016.

Mahindra (2021, October 26). Press Release: Mahindra launches Treo electric auto at NPR 8,400,00. https://www.mahindra.com/news-room/press-release/en/mahindra-launches-treo-electric-auto-at-npr-840000#.

Mazda, n.d.. MAZDA-GO 3-WHEELED TRUCKS（1931～). Retrieved 09 February 2019 https://web.archive.org/web/20190209124028/https://www.mazda.com/en/innovation/stories/greatcar/mazda-go/.

Minghong Motors. (2023, July 06). Who Invented The Auto Rickshaw. https://minghongmotors.com/who-invented-the-auto-rickshaw/.

Ministry of Heavy Industries (2024, May 06). FAME II Dashboard as on date 06-05-2024. https://fame2.heavyindustries.gov.in/dashboard.aspx.

Ministry of Road Transport and Highway. (2023). Road Transport Year Book (2019-20). Wikipedia. Retrieved June 4, 2024, from https://morth.nic.in/sites/default/files/RTYB_Publication_2019_20%20(1).pdf

NITI Aayog, SIDBI, RMI (2024). De-Risking Lending for a Brisk EV Uptake: A Practical Guide on De-Risking Measures for Electric Two- and Three-Wheelers in India. https://www.sidbi.in/head/uploads/greenpathwayseseries_documents/green-series-de-risking-lending.pdf.

OMI Foundation. (2023, April). Ease of Moving Index - India Report 2022 - Factsheets. https://olawebcdn.com/ola-institute/easeofmoving-2022-factsheet.pdf.

OMI Foundation. (n.d.). EV Ready India. EV Ready India. Retrieved June 3, 2024, from https://evreadyindia.org/ev-policies/

Palak Thakur and Sugandha Pal. 2019. Regulatory Mechanisms for Electric Three-Wheelers, TERI Policy Brief.New Delhi: The Energy and Resources Institute. https://www.teriin.org/sites/default/files/2020-02/Policy%20brief%20-%20EV%20Three-wheelers.pdf.

Patel, S. (2024, April 12). Two wheeler, three wheeler and CV exports skid in FY24 on global woes. Business Standard. https://www.business-standard.com/industry/news/two-wheeler-three-wheeler-and-commercial-vehicle-exports-fall-in-fy24-124041200934_1.html.

Press Information Bureau (2024, March 13). Ministry of Heavy Industries announces Electric Mobility Promotion Scheme 2024. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2014366#.

Rao, R., S. Maiti, and P. Mulukutla. 2023. "Assessing the Viability of Using Autorickshaws for Urban Freight Delivery in India." Working Paper. WRI India. Available online at https://doi.org/10.46830/wriwp.22.00111.

SIAM (2023). Society of Indian Automobile Manufacturers Annual Report 2022-23. https://www.siam.in/uploads/filemanager/SIAMANNUALREPORT2022-23.pdf.

Singh, R., Mishra, S., & Tripathi, K. (2021). Analysing acceptability of E-rickshaw as a public transport innovation in Delhi: A responsible innovation perspective. Technological Forecasting and Social Change, 170, 120908. https://doi.org/10.1016/J.TECHFORE.2021.120908.

Team BHP. (n.d.). Vintage Cars and Classics in India. team-BHP. Retrieved June 4, 2024, from https://www.team-bhp.com/forum/vintage-cars-classics-india/31864-classic-advertisement-brochure-thread-42-print.html

TNN. (2017, March 16). No permit required for e-rickshaws | Noida News. Times of India. Retrieved May 8, 2024, from https://timesofindia.indiatimes.com/city/noida/no-permit-required-for-e-rickshaws/articleshow/57659313.cms.

Trucksdekho (n.d.). Three Wheelers - Cargo & Passenger Vehicle. https://trucks.cardekho.com/en/popular-truck/3-wheeler.html.

UCLA & Ola Mobility Institute. 2020. Electrification of on-demand mobility in Delhi: Strategic Locations for the Installation of Charging Stations. September 2020.

VAHAN Dashboard, Ministry of Road Transport & Highways, Government of India. Accessed 29 April 2024.

Whelan, C. (2012, April 06). Different Strokes: New Lower-Pollution Auto Rickshaw Engines Could Save Lives and Curb Climate Change. Scientific American. https://www.scientificamerican.com/article/better-engines-for-rickshaws/.

Yann Philippe Tastevin. (2015). The Indian Auto Rickshaw in Egypt: An Ethnography of Transnational Trade Connections. Articulo - Journal of Urban Research [Online], 12 | 2015, Online since 14 February 2016, connection on 08 May 2024. URL: http://journals.openedition.org/articulo/2872; DOI: https://doi.org/10.4000/articulo.2872.

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